Inventor: CHARLES ET AL
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Examiner: Nguyen
Group Art Unit: 1754

REMARKS

Claim 21 has been added. Support for this claim can be found at least on page 3, line 40 to page 4, line 1 of the specification.

The present invention relates to a process for continuously producing chlorine dioxide comprising the steps of: feeding chlorate ions, acid and hydrogen peroxide as aqueous solutions to a reactor; reducing chlorate ions in the reactor to chlorine dioxide, thereby forming a product stream in the reactor containing chlorine dioxide; feeding motive water in an eductor comprising a nozzle; bringing the motive water to flow through the nozzle and causing it to flow further through the eductor in an at least partially spiral or helical manner; transferring the product stream from the reactor to the eductor and mixing it with the motive water and thereby forming a diluted aqueous solution containing chlorine dioxide, and withdrawing the diluted aqueous solution containing chlorine dioxide from the eductor.

The Examiner has rejected the claims under 35 U.S.C. § 103 as obvious over Engström et al (US 5091166) in view of Sprauer (US 2833624), Isa et al (US 4421730) and Ciuti et al (US 4026817).

First a brief review of these documents.

Engström et al discloses a process for the production of chlorine dioxide in an aqueous reaction medium maintained in a single reaction vessel including the steps of providing a gaseous mixture containing steam, oxygen and chlorine dioxide, removing the gaseous mixture from the single reaction vessel and maintaining the liquid level in the single reaction vessel substantially constant. There is no disclosure of transferring a product stream from the reactor to an eductor fed with motive water that is caused to flow

in an at least partially spiral or helical manner.

Sprauer discloses a process for the production of chlorine dioxide comprising feeding aqueous solutions of a chlorate, a chloride, hydrogen peroxide and a strong mineral acid into a reaction zone and removing reacted mixture comprising a solution of chlorine dioxide from the reaction zone. There is no disclosure of transferring a product stream from the reaction zone to an eductor fed with motive water that is caused to flow in an at least partially spiral or helical manner.

Isa et al discloses a process for the production of chlorine dioxide in a single generator crystallizer, from which a mixture of chlorine dioxide and water vapour is removed and absorbed in water with a water ejector. There is no disclosure that the ejector is fed with motive water that is caused to flow in an at least partially spiral or helical manner.

Ciuti et al discloses a method of preparing an oil in water emulsion by causing a stream of water to flow through a duct containing a Venturi and drawing oil for emulsification to the duct a zone upstream of the Venturi. There is no disclosure whatsoever that this duct could be used in a process for the production of chlorine dioxide.

The Examiner has alleged that it would be obvious to absorb the chlorine dioxide product of Engström et al into an aqueous stream using the duct suggested by Ciuti et al. Applicants respectfully disagree. The Examiner provides no credible reason why the skilled artisan would modify the Engström et al process to incorporate the Venturi of Ciuti et al. Rather, she provides only an unsupported conclusion that the Ciuti et al Venturi "would increase the ejection effect of the venturi or the penetration of the flow to facilitate mixing between the chlorine dioxide and the

aqueous solution." Where is there any indication in any of the cited references that this is indeed the case? Ciuti et al is concerned only with the emulsification of oil in water, that is, the mixing of two immiscible liquid streams. In contrast, Engström et al relates to the recovery of chlorine dioxide gas, which is miscible (i.e., absorbed) in water vapor, and Sprauer et al and Isa et al relate chlorine dioxide gas contained or absorbed in an aqueous stream.

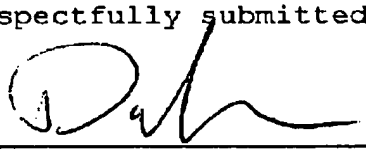
The phase equilibria thermodynamics of gas/liquid absorption systems bear little if any resemblence to liquid/liquid immiscible systems such as the oil in water system described in Ciuti et al. The phase relationship of the components is different in each case. This relationship can have a tremendous bearing on how each particular system responds to the application of a motive water stream. With this in mind, how does the Examiner justify the conclusion that the Venturi of Ciuti et al would function in a predictable and advantageous manner in the completely different environment of chlorine dioxide absorption? Absent such an explanation, the Examiner fails to establish a prima facie case of obviousness.

Furthermore, in the prior art there are numerous devices for mixing two fluid streams. While one such device is an eductor, such eductors have before the present invention never been used or been suggested to be used in a process for the production of chlorine dioxide. The fact that an eductor is recommended for use in the preparation of an oil and water emulsion does not motivate a person skilled in the art to use it in a process for the production of chlorine dioxide, particularly as there is no indication whatsoever in the prior art that it would be advantageous to do so instead of using any other kind of mixing device.

On the other hand, it was found through the present invention that higher production rate and/or higher concentration of chlorine dioxide could be obtained, which was totally unexpected. Thus, in view of the prior art it cannot be obvious to a person skilled in the art to use this kind of eductor in any process for the production of chlorine dioxide, such as those disclosed in Engström, Sprauer or Isa, and particularly not in a process as claimed in the present application.

The Commissioner is hereby authorized to charge any required fees associated with this communication and during the pendency of the application under 37 CFR 1.16 and 37 CFR 1.17 or to credit any overpayment to Deposit Account No. 501348. This sheet is submitted in duplicate.

Respectfully submitted,



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I hereby certify that this correspondence is being transmitted by facsimile this day to Examiner Nguyen at the United States Patent and Trademark Office, Art Unit 1754, to fax No. 703-872-9306.

10 Feb 2004 

Date Signature